

FIVE-YEAR REVIEW REPORT

Second Five-Year Review Report for Chemical Sales Company Superfund Site Denver and Adams Counties, Colorado

September 2002

Prepared By:

**REGION VIII
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
DENVER, COLORADO**

Approved by:

Date

-signed-

September 25, 2002

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List of Acronyms

ARARS	Applicable or Relevant and Appropriate Requirements
BTEX	Benzene, Toluene, Ethyl Benzene, Xylene
BZ	Benzene
CDPHE	Colorado Department of Public Health and the Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DCA	1,1-dichloroethane
DCE	1,1-dichloroethylene
EPA	Environmental Protection Agency
GAC	Granular Activated Carbon
HASP	Health and Safety Plan
KWTF	Klein Water Treatment Facility
LNAPL	Light Non-aqueous Phase Liquid
MCLs	Maximum Contaminant Levels
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operation and Maintenance
OU _s	Operable Units
PCE	Tetrachloroethylene
POTW	Publicly Owned Treatment Works
PRP	Potentially Responsible Party
RALs	Risk Action Levels
RI/FS	Remedial Investigation/Feasibility Study
RMA	Rocky Mountain Arsenal
ROD	Record of Decision
SACWSD	South Adams County Water and Sanitation District
SSC	Superfund State Contract
SVE	Soil Vapor Extraction
TCA	1,1,1-trichloroethane
TCE	Trichloroethylene
VC	Vinyl Chloride
VOC _s	Volatile Organic Compounds

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Executive Summary

EPA Region 8 has conducted the second five-year review of the remedial actions implemented at the Chemical Sales Company Superfund Site (Site) located in Adams County, Colorado. The review was conducted from January through September 2002. The results of the five-year review indicate that the remedy is expected to be protective of human health and the environment.

Overall, the Air Sparging/Soil Vapor Extraction System (system) is operating as designed. Contaminant levels in OU 1 monitoring wells are generally decreasing due to the system and natural degradation. The contaminated groundwater underlying OU 2 has remained within predicted plume boundaries. OU 2 (north of OU 1) has not been impacted yet by the operation of the OU 1 system. Present contaminant levels in groundwater are consistent with expectations at the time of the Site's decision documents.

A couple of deficiencies that do not immediately impact the protectiveness of the remedy were identified. Contamination under and around the Trammel Crow Building (just west of the CSC property) is not decreasing as quickly as the other areas of contamination. VOC concentrations in monitoring wells around the building are relatively very high. Injection of agents into the subsurface to facilitate biodegradation of VOCs by anaerobic dechlorination of VOCs should be explored within a year of this report.

Although the indoor air pathways at the three homes sampled were found to pose no unacceptable exposure, the home (5801R52) with the highest PCE concentration needs further review as a precautionary measure. The ambient air sample for 5801R52 indicated a PCE concentration of 45 ug/m³ which is higher than the PCE concentration of 8.1 ug/m³ from the indoor air sample. The home should be sampled again within a year of this report. The foundation and basement should be checked for cracks. Other sources of VOCs in and around the home should also be checked.

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Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name (<i>from WasteLAN</i>): Chemical Sales Company Superfund Site		
EPA ID (<i>from WasteLAN</i>): COD007431620		
Region: 8	State: CO	City/County: Denver/Denver County; Commerce City, Adams County
SITE STATUS		
NPL status: <input checked="" type="checkbox"/> Final <input type="checkbox"/> Deleted _____		
Remediation status (choose all that apply): <input type="checkbox"/> Under Construction <input checked="" type="checkbox"/> Operating <input type="checkbox"/> Complete		
Multiple OUs? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Construction completion date: March 27, 2000	
Has site been put into reuse? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		
REVIEW STATUS		
Reviewing agency: <input checked="" type="checkbox"/> EPA <input type="checkbox"/> State <input type="checkbox"/> Tribe <input type="checkbox"/> Other <u>Federal Agency</u> _____		
Author name: Armando Saenz		
Author title: Remedial Project Manager	Author affiliation: EPA Region 8	
Review period: January 2002 to September 2002		
Date(s) of site inspection: September 3, 2002		
Type of review: <input checked="" type="checkbox"/> Statutory <input type="checkbox"/> Policy (<input type="checkbox"/> Post-SARA <input type="checkbox"/> Pre-Sara <input type="checkbox"/> NPL-Removal only <input type="checkbox"/> Non-NPL Remedial Action Site <input type="checkbox"/> NPL State/Tribe-lead <input type="checkbox"/> Regional Discretion)		
Review number: <input type="checkbox"/> 1(first) <input checked="" type="checkbox"/> 2 (second) <input type="checkbox"/> 3 (third) <input type="checkbox"/> Other (specify) _____		
Triggering action: <input type="checkbox"/> Actual RA Onsite Construction at OU # ____ <input type="checkbox"/> Actual RA Start at OU# ____ <input type="checkbox"/> Construction Completion <input checked="" type="checkbox"/> Previous Five-Year Review Report <input type="checkbox"/> Other (specify) _____		
Triggering action date (<i>from WasteLAN</i>): 9/29/97		
Due date (<i>five years after triggering action date</i>): 9/29/02		

Five-Year Review Summary Form

Deficiencies:

Two deficiencies were identified:

1. **Degradation Enhancement.** Contamination under and around the Trammel Crow Building (just west of the CSC property) is not decreasing as quickly as the other areas of contamination. VOC concentrations in monitoring wells around the building are relatively very high.
2. **Continued Indoor Air Monitoring.** Although the indoor air pathways at the three homes sampled were found to pose no unacceptable exposure, the home (5801R52) with the highest PCE concentration needs further review as a precautionary measure. The ambient air sample for 5801R52 indicated a PCE concentration of 45 ug/m³ which is higher than the PCE concentration of 8.1 ug/m³ from the indoor air sample.

Recommendations and Follow-up Actions:

With EPA oversight, the corresponding recommendations/follow-up actions are as follows:

1. **Degradation Enhancement.** Injection of agents into the subsurface to facilitate biodegradation of VOCs by anaerobic dechlorination of VOCs should be explored within a year of this report. The area of interest should center on the Trammel Crow Building just west of the CSC property.
- 2, **Continued Indoor Air Monitoring.** The home (5801R52) should be sampled again within a year of this report. The foundation and basement should be checked for cracks. Other sources of VOCs in and around the home should also be checked.

Protectiveness Statement(s):

The remedy at the Chemical Sales Company Superfund Site is expected to be protective of human health and the environment. The AS/SVE System is operating as designed. Contaminant levels in OU 1 monitoring wells are generally decreasing due to the system and natural degradation. The contamination of the groundwater, underlying OU 2, has remained within predicted plume boundaries. Present contaminant levels in groundwater are consistent with expectations at the time of the Site's decision documents.

Chemical Sales Company Superfund Site Second Five-Year Review Report

INTRODUCTION

EPA Region 8 has conducted a five-year review of the remedial actions implemented at the Chemical Sales Company Superfund Site (Site) located in Denver and Adams Counties, Colorado. This review was conducted from January through September 2002. This report documents the results of the review. The purpose of five-year reviews is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports. In addition, five-year review reports identify deficiencies found during the review, if any, and identify recommendations to address them.

This review is required by statute. EPA must implement five-year reviews consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121(c), as amended, states:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented.

The NCP [Part 300.430(f)(4)(ii) of the Code of Federal Regulations (CFR)] states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

This is the second five-year review for the Site. The triggering action for this review was the completion of the first five-year on September 29, 1997. Due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unrestricted use and unlimited exposure, another five-year review is required.

BACKGROUND

In 1981, the EPA conducted a random national survey of drinking water systems. Several organic chemicals were found by EPA in South Adams County Water and Sanitation District

(SACWSD) wells. Additional sampling in 1982 and 1985 confirmed this result. EPA then initiated a Remedial Investigation (RI) and Feasibility Study (FS) on an area named "EPA's Off-Post RMA OU1". This area was bounded by East 80th Avenue to the north; East 56th Avenue to the south; South Platte River to the west; and the Rocky Mountain Arsenal (RMA) to the east. The results of the RI indicated extensive contamination of groundwater along the eastern portion of the area. See Figure 1.

A permanent water treatment plant for SACWSD water was the selected remedy for the EPA Off-Post RMA OU1 ROD dated June 4, 1987. The permanent treatment plant was built and named the Klein Water Treatment Facility (KWTF). It is near the SACWSD municipal water supply center at East 77th Avenue and Quebec Street. The KWTF began operating in October 1989. It now protects the health of SACWSD municipal water supply users by treating alluvial groundwater prior to distribution. Also, approximately 400 residents using private wells were connected to the SACWSD municipal water supply under EPA removal actions between 1986 and 1988.

The RMA was suspected as one of the potential sources of groundwater contamination in the EPA's Off-Post RMA Study Area due to its history of waste disposal practices. Investigations by the EPA's Field Investigation Team indicated the potential for other source areas to also be contributing to groundwater contamination. In 1986, soil gas surveys and groundwater investigations revealed the presence of volatile organic contaminants (VOCs) in the vicinity of the CSC facility. The presence of TCE and other chlorinated hydrocarbons near the CSC was confirmed by another soil gas survey in August 1987. Groundwater monitoring wells installed on the CSC property have confirmed CSC as a source of groundwater contamination. The chemicals of concern (COCs) for the Site are:

- 1,1-dichloroethane (DCA)
- 1,1-dichloroethylene (DCE)
- Total 1,2-dichloroethylene (total 1,2-DCE)
- 1,1,1-trichloroethane (TCA)
- Trichloroethylene (TCE)
- Tetrachloroethylene (PCE)
- Benzene (BZ)
- Vinyl Chloride (VC)

The CSC Site was proposed for listing on the National Priorities List (NPL) in June 1988. Investigations for all EPA RMA Off-Post work was then transferred from the EPA Off-Post RMA Study Area to the CSC Site. The NPL listing was made final in August 1990.

Subsurface soils and groundwater are contaminated at the Site. The contaminated groundwater is located in an unconfined alluvial aquifer, which extends to a maximum depth of 100 feet below the ground surface. Groundwater flow on the Site generally moves north and north-northwest. Paleochannels also influence the flow. The Site is divided into four operable units.

Operable Unit 1. OU 1 consists of contaminated subsurface soils on the CSC property and groundwater contamination south of Sand Creek. The land use in OU1 is mainly industrial.

The CSC property was the location of a former chemical sales business. Subsurface soil contamination on and adjacent to the property is considered to be the source of the groundwater contamination. The contaminated groundwater flows northward into the other OUs.

OU 1 is located in Denver and Commerce City. The Plume Area of OU 1 consists of the area south of Sand Creek and north of East 48th Avenue, between Monaco and Forest Streets. The Source Area includes the CSC property at 4661 Monaco Street and consists of the area south of East 48th Avenue, north of Interstate 70, between Monaco and Forest Streets. See Figure 2.

Operable Unit 2. OU 2 addresses the VOC-contaminated groundwater north of Sand Creek (and downgradient of OU1). The RMA borders OU2 to the east. OU2 is approximately four square-miles in area. The land use consists of single and multi-family residences, small businesses, and municipal facilities. Boundaries of OU1 and OU2 are defined by the approximate extent of the groundwater contamination, and may expand as groundwater contaminants migrate. No soil contamination has been found in this OU. See Figure 1.

Operable Unit 3. OU3 addresses residential exposure to contaminated groundwater in OU 2. OU3 has the same boundaries as OU2.

Operable Unit 4. OU4 addresses SACWSD Wells 18, 21, and 47. The wells draw water from the alluvial aquifer north of OU2 and provide water to residents connected to SACWSD.

REMEDIAL ACTIONS

Remedy Selection & Implementation

Operable Unit 1

OU1 consists of the contaminated soils located on and around the CSC property and groundwater contamination south of Sand Creek. The OU 1 Record of Decision was signed on June 27, 1991 and included the following components:

- ▶ Treatment of contaminated groundwater with two air stripping towers for both the source and plume areas;
- ▶ Re-injection and/or re-infiltration of treated groundwater;

- ▶ Soil Vapor Extraction (SVE) for treatment of contaminated soils exceeding soil remediation levels; and
- ▶ Catalytic oxidation for treatment of air emissions from the SVE system and air stripping unit plus recirculation of exhaust from the catalytic oxidation system into the contaminated soil.

As a result of new information from hydrogeologic investigations, an Explanation of Significant Differences (ESD) was signed December 11, 1995 specifying changes to the original remedy related to the Source Area. These changes included:

- ▶ Use of air sparging rather than air stripping;
- ▶ Recirculation of treated exhaust (off-gas) from the catalytic oxidation system into the soils would not be conducted; and
- ▶ The use of resin adsorption rather than catalytic oxidation.

The performance standards for the Site include remediation levels for groundwater (Table 5 in ROD) and remediation levels for soils based on leaching of soil contaminants into the underlying groundwater (p. 52 of ROD).

On August 12, 1997, EPA signed a Cooperative Agreement for the CDPHE to conduct the Remedial Design (RD), thus making CDPHE the lead agency for OU 1. CDPHE completed the RD via subcontractor on June 25, 1998.

During RD activities, more hydrogeologic information was acquired and another ESD was signed on March 27, 2002. The ESD calls for the use of monitored natural attenuation rather than active remediation in the Plume Area of OU 1.

CDPHE formally awarded the RA Contract on August 19, 1998, thereby initiating the RA. CDPHE conducted remedial activities as planned. EPA and CDPHE conducted pre-final inspections on September 30, 1999 and February 16, 2000.

Punch list items from the pre-final inspections were completed by March 2000 and the AS/SVE System was then considered operational and functional. O&M of the system is ongoing.

Operable Unit 2

OU2 addresses the VOC-contaminated groundwater north of Sand Creek. Two distinct groundwater plumes have been identified - a trichloroethylene (TCE) plume and a tetrachloroethylene (PCE) plume. A ROD for OU 2 was signed on June 27, 1991. The major components of the remedy for OU2 included: 1) extraction of contaminated groundwater within

the plumes; 2) treatment of the groundwater by air stripping technology; 3) re-injection of the treated groundwater by injection wells; 4) monitoring of groundwater; 5) continued capture and treatment of contaminated groundwater by the existing Klein Water Treatment Facility (KWTF); and, 6) voluntary abandonment of bedrock wells.

An ESD for OU2 was signed November 29, 1994. It specified changes to the original remedy. In the original remedy the PCE plume was going to require active treatment by air stripping, and reinjection of the treated water into the aquifer. New information indicated that the high concentrations of PCE had dispersed and no longer required active treatment. Thus, the first three components of the original remedy were eliminated by this Explanation of Significant Differences.

Field activities performed from September 5, 1995 through November 30, 1995 to fulfill the monitoring component. The initial groundwater sampling event for the groundwater well network was conducted in November 1995. The second semi-annual sampling event was performed in June 1996. Under a Cooperative Agreement, the Colorado Department of Public Health and Environment (CDPHE) has conducted the OU 2 monitoring since 1999.

Operable Unit 3

OU3 addresses residential exposure to contaminated groundwater in the geographic area known as OU 2. There are 11 private alluvial wells located along the OU2/Rocky Mountain Arsenal boundary area. The major components of the selected remedy as stated in the OU3 Record of Decision, dated June 27, 1991, included: connection of private alluvial well users to the SACWSD water system; for residences located in rural areas without reasonable access to SACWSD water lines, provision for individual home activated treatment units; and, notification of potential health risks associated with contaminated groundwater, upon request for an alluvial well permit within Site boundaries.

The installations were completed with the final inspection for all residences occurring on September 30, 1992. Of a total of 15 possible eligible connections, ten connections or partial connections were made. Residents at five locations elected not to be connected to the municipal water supply. Subsequently, a connection was made on October 4, 1995 to one of the residences which had previously declined the installation.

Operable Unit 4

OU4 addresses SACWSD Wells 18, 21, and 47. These wells draw water from the alluvial aquifer north of OU2 and provide water to residents connected to SACWSD.

The original remedy selected in the Record of Decision signed December 29, 1992 remedy included: connection of the three wells to the KWTF; treatment of well water at the KWTF by granulated active carbon to below MCLs in compliance with the Off-Post RMA OU1 Record of Decision; regeneration of spent carbon off-site; transmission of treated water to a reservoir for

storage; and quarterly monitoring of the three wells.

Because contaminant levels in groundwater in the northern part of OU 2 decreased to well below MCLs, the originally selected remedy was no longer needed and a No-action ROD Amendment was signed on September 23, 1999. The three wells will be monitored by SACWSD for as long as the KWTF is in operation.

Operation & Maintenance (O&M)

OU 1 is the only OU requiring O&M. OUs 1 and 2 require separate groundwater monitoring programs. OUs 3 and 4 are complete and protective of human health and the environment. All O&M activities are being conducted by the CDPHE under a cooperative agreement with the EPA.

The remediation system consists of remediation and monitoring wells and an aboveground treatment unit. The remediation wells, comprised of soil vapor extraction (SVE) and air sparging (AS) wells, are connected to the aboveground treatment unit via several thousand feet of underground, interconnected piping. The monitoring wells, including groundwater monitoring wells and soil gas pressure monitoring points, are situated in various locations inside and outside the site boundary.

The aboveground treatment unit is a core component of the entire remediation system. The treatment unit consists of air injection, extraction and treatment equipment. Subsurface soil vapor is first collected via SVE wells using the extraction equipment. Upon entering the treatment building (which houses the aboveground treatment unit), the soil vapor is treated in the vapor treatment equipment prior to its release to the atmosphere. Liquid entrained in the soil vapor is separated from the vapor stream in the liquid/vapor separator. Liquid collected in the separator is then pumped into the granular activated carbon (GAC) equipment before being discharged to the sanitary sewer. The air injection equipment is used to inject air below the groundwater table via the AS wells. The air sparging and vapor extraction processes occur simultaneously to facilitate the removal of the contaminants in the subsurface soil and groundwater at the Site. The system has been operating continuously since March 2000. See Figure 3 for location of the treatment facility.

Groundwater Monitoring

OU 1 Groundwater Monitoring

A total of nineteen wells in OU 1 are sampled on a semi-annual basis in order to:

- ▶ Monitor the reduction of VOC contamination in Source Area wells due to the operation of the AS/SVE System (and treatment of contamination); and,

- ▶ Evaluate the reduction of VOC contamination in Plume Area wells due to the operation of the AS/SVE System (which is upgradient of the Plume Area) and natural attenuation processes.

Ten wells are sampled in the Plume Area and nine wells are sampled in the Source Area. These wells effectively define the center of mass and the periphery of the OU 1 groundwater plume. See Figure 3 for location of wells.

OU 2 Groundwater Monitoring

Twenty six wells in OU 2 are sampled on a semi-annual basis in order to:

- ▶ Determine the extent of movement of the contaminant plume; and,
- ▶ Observe any increase/decrease in contaminant concentrations.

As the operation of the OU 1 AS/SVE System proceeds, the impact on OU 2 groundwater will be evaluated. See Figure 4 for well locations.

Indoor Air Sampling

Because of the nature and extent of the VOC-contaminated groundwater and the lack of residential indoor air sampling data, CDPHE conducted an investigation of the indoor air pathway in the limited residential area of OU 1. The purpose of the investigation was to determine whether there is an unacceptable risk to human health from chemical vapors.

The Plume Area was chosen because the Source Area, the most contaminated area, does not have residential homes. In addition, the groundwater in the Plume Area is more contaminated than in OU 2. The contaminated groundwater moves in a northwardly direction from the Source Area to the Plume Area then to OU 2.

Three homes were sampled from May 24th through June 4, 2002. Samples were taken from basements and ambient air samples were taken just outside the homes.

Progress Since The Last Five-Year Review

For the first five-year review, the remedy was found to be protective of human health and the environment and no deficiencies were noted. Since the last five-year review, Construction Completion was achieved for the Site on March 27, 2000.

FIVE-YEAR REVIEW PROCESS

The Five-year Review was led by Armando Saenz, Remedial Project Manager for the Site. The following team members assisted in the review:

- ▶ Fonda Apostolopoulos, CDPHE Project Manager
- ▶ Richard Sisk, EPA Attorney
- ▶ Rob Henneke, EPA Community Involvement Coordinator

The five-year review consisted of the following activities: a review of relevant documents; interviews; review of ARARS and O&M data; and, site visits. Notices stating that the five-year review was in progress were placed in The Denver Post and the Rocky Mountain News on August 9, 2002. Notices of completion of the five-year report will also be placed in The Denver Post and the Rocky Mountain News.

FIVE-YEAR REVIEW FINDINGS

Interviews

The following individuals were interviewed by Armando Saenz during the five year site inspection on September 3, 2002:

- ▶ **Fonda Apostolopoulos, CDPHE.** Mr. Apostolopoulos is the CDPHE Project Manager for the Site. The Site is a state-lead site.
- ▶ **Edward Fink, CET Environmental Services.** Mr. Fink is the Treatment Plant Operator for the AS/SVE System. CET is the operations contractor.

Fonda Apostolopoulos

Mr. Apostolopoulos stated that he thought the AS/SVE System was both effective and efficient. He mentioned that the amount of contamination being treated by the system has steadily decreased due to the effectiveness of the system and decrease of source material. The operator, CET, essentially locates the most contaminated areas (via the network of wells) and then directs the operation of the system to those areas. The areas currently being treated are not as contaminated as those a couple of years ago.

He was concerned about the impact of the severe drought conditions on the operation of the system and groundwater monitoring. Drought conditions have decreased the amount of groundwater, thus increasing VOC concentrations. This, in turn, has led to groundwater

sampling results that may not be representative of current contaminant levels. Monitoring results are used to monitor the extent of the plume and to measure treatment system performance.

He stated that the contamination under and around the Trammel Crow Building (just west of the CSC property) was not decreasing as the other areas of contamination. VOC concentrations in monitoring wells around the building were relatively very high. He expressed the desire to explore the injection of agents into the subsurface to facilitate biodegradation of VOCs by anaerobic dechlorination of VOCs to non-toxic forms (i.e. ethane/ethene) under and around the building.

He also stated that he thought CET was doing a very good job of operating the system.

Edward Fink

Mr. Fink has been the Treatment Plant Operator of the system since July 2000. He essentially agreed with what Mr. Apostolopoulos said at the inspection. He stated that the system is running better now than it ever has, especially compared to when the previous operator ran it. He briefly mentioned that CET inherited a number of operational problems when they were awarded the contract in March 2000. The problems have subsequently been addressed and system is now humming.

As a result of increasing the efficiency of the treatment system, the amount of sodium hydroxide used in the neutralization process at the scrubber unit has decreased dramatically, further decreasing the costs associated with running the facility.

Site Inspection

The Site was inspected on September 3, 2002. The inspection evaluated the AS/SVE System and associated wells. The structure housing the system and the system itself were exceptionally clean and well maintained. The system appeared to operate as designed and the wells (AS, SVE and monitoring wells) that were reviewed were in good condition and operating as designed. No significant O&M problems were encountered.

ARARs Review

As part of the five-year review, Applicable and Relevant and Appropriate Requirements (ARARs) were reviewed. The primary purpose of this review was to determine if any newly promulgated or modified requirements of federal and state environmental laws have significantly changed the protectiveness of the remedies implemented at the Site. The ARARs reviewed were those included in the Site's decision documents.

Overall, the review does not indicate any substantive changes to regulations that would affect the remedy nor its protectiveness. EPA and CDPHE will continue to monitor this Site and any future changes or modifications in ARARs will be reported in the next five-year review.

Data Review for AS/SVE System

The remediation system consists of remediation and monitoring wells and an aboveground treatment unit. The remediation wells, comprised of soil vapor extraction (SVE) and air sparging (AS) wells, are connected to the aboveground treatment unit via several thousand feet of underground, interconnected piping. The monitoring wells, including groundwater monitoring wells and soil gas pressure monitoring points, are situated in various locations inside and outside the site boundary.

The aboveground treatment unit is a core component of the entire remediation system. The treatment unit consists of air injection, extraction and treatment equipment. Subsurface soil vapor is first collected via SVE wells using the extraction equipment. Upon entering the treatment building (which houses the aboveground treatment unit), the soil vapor is treated in the vapor treatment equipment prior to its release to the atmosphere. Liquid entrained in the soil vapor is separated from the vapor stream in the liquid/vapor separator. Liquid collected in the separator is then pumped into the GAC equipment before being discharged to the sanitary sewer. The air injection equipment is used to inject air below the groundwater table via the AS wells. The air sparging and vapor extraction processes occur simultaneously to facilitate the removal of the contaminants in the subsurface soil and groundwater at the Site. The system has been operating continuously since March 2000. See Figure 3 for location of the treatment facility.

A review of records and monitoring reports (from July 2001 through July 2002) indicates that the AS/SVE system is being operated and maintained as required by the Remedial Design (June 1998), the Request for Proposal (January 2000) and the CDPHE Contract with CET (June 2000). Also, O&M of the various components of the system is conducted in accordance with the site O&M manual and appropriate manufacturer's O&M manuals.

The system has been successful. The following is an analysis of data from July 2001 through July 2002. With prior resolution of operational glitches, the system appeared to have reached stable conditions during this period. This period is representative of future conditions of the system.

VOC Mass Recovered

The mass of individual VOC compounds recovered from the subsurface is calculated with the use of the following formula:

$$\text{VOC Mass Recovered} = \text{Influent Concentration} \times \text{Vapor Density} \times \text{Flow} \times \text{Time}$$

Adsorber influent samples typically include PCE, TCE and TCA. Other VOCs are usually found in low concentrations (<1 ppm).

The monthly amounts of VOCs recovered from the subsurface from July 2001 through July 2002

are shown in Figure 5. The monthly estimate is based on inlet sample results, average airflow measured at the adsorber inlet and the number of hours of operation for that month. Figure 5 suggests that available contamination in the subsurface is decreasing with the continued operation of the system (and treatment of contamination). As of July 2002, the total estimated amount of VOC mass recovered is 11,871.5 pounds.

VOC Mass Treated

Treatment of VOC mass recovered involves the off-gas adsorption unit and the liquid phase GAC unit. However, as shown below, all of the VOC mass recovered at the Site is treated by the adsorption unit.

Granular Activated Carbon (GAC) Unit. Samples from the influent and effluent of the GAC unit are collected on a monthly basis. None of the contaminants of concern were detected in the influent/effluent water samples collected from the GAC unit from July 2001 to July 2002.

Off-gas Adsorption Unit. The mass of individual VOC compounds treated by the adsorption unit is calculated using the following formula:

$$\text{VOC Mass Treated} = \text{VOC Mass Recovered} - (\text{Effluent Concentration} \times \text{Vapor Density} \times \text{Flow} \times \text{Time})$$

The VOC mass treatment efficiency is calculated as follows:

$$\% \text{ Efficiency} = \text{VOC Mass Treated} / \text{VOC Mass Recovered} \times 100$$

The calculated mass treatment rates from July 2001 through July 2002 are shown in Table 1. The average mass treatment efficiency for the period was 98.3%. The APEN for the Site requires a mass treatment efficiency of 95%.

Data Review for Groundwater Monitoring

OU 1 Groundwater Monitoring

A total of nineteen wells in OU 1 are sampled on a semi-annual basis to monitor the reduction of VOC contamination in Source Area wells due to the operation of the AS/SVE System (and treatment of contamination) and to evaluate the reduction of VOC contamination in Plume Area wells due to the operation of the AS/SVE System (which is upgradient of the Plume Area) and natural attenuation processes. Typically, ten wells are sampled in the Plume Area and nine wells

are sampled in the Source Area. These wells effectively define the center of mass and the periphery of the OU 1 groundwater plume.

Trend analysis of the sampling data from 1990 to April 2002 for select wells in the Source and Plume Areas was conducted. The analysis includes sampling data since operation of the AS/SVE System began in March 2000.

Source Area. Wells included in the trend analysis for the Source Area were LSS-MW-7, 8B, 11, 13 and 14. Figures for each of the wells in Appendix A generally suggest a decreasing trend for most contaminants of concern with a slight peak at the end of the time period. The decreasing trend is mainly due to the ongoing treatment of VOC contamination and natural degradation. The general increase in concentrations for most of the COCs during the last sampling event (April 2002) is likely due to the severe drought conditions and the subsequent lowering of the well pumps. The severe drought conditions have decreased the amount of groundwater and thus increased VOC concentrations. Given VOC densities, lowering the pumps to the bottom of the wells usually provides a better representation of what is in the groundwater. The density of the contaminants is greater than water.

Plume Area. Wells included in the trend analysis for the Plume Area were LSS-MW-20A, 20B, 21B and 22B. Figures for each of the wells in Appendix B generally suggest a decreasing trend for most contaminants of concern with a slight peak at the end of the time period. The decreasing trend is mainly due to the ongoing treatment of VOC contamination and natural degradation. The general increase in concentrations for most of the COCs during the last sampling event (April 2002) is also likely due to the severe drought conditions and the subsequent lowering of the well pumps.

OU 2 Groundwater Monitoring

Twenty six wells in OU 2 are sampled on a semi-annual basis to determine the extent of movement of the contaminant plume and to observe any increase/decrease in contaminant concentrations. As the operation of the OU 1 AS/SVE System proceeds, the impact on OU 2 groundwater will be evaluated. Sampling is conducted in accordance with the *Field Logistics for Groundwater Sampling at Chemical Sales Company Superfund Site, Operable Unit II* (CDPHE, February 1999) which is approved by EPA.

Figure 4 shows the well locations within OU 2. Appendix C provides data summary tables from November 1995 to May 2002 for the twenty six monitoring wells. PCE and TCE are typically detected in multiple samples above MCLs (5 ug/L for PCE and TCE). One or both are typically exceeded wells CMW-05, CMW-06, CMW-13, CDM-198-605, FIT-IM-WP-1 and FIT-IM-WP2.

As expected, the highest concentrations of VOCs are detected in wells located along the southern boundary of OU 2. The highest concentrations of organic compounds are usually found in FIT-IM-WP-1 and FIT-IM-WP-2 which are located just north of Sand Creek (and immediately downgradient of OU 1).

Where wells are paired, the well that is screened lower in the alluvium generates samples with higher concentrations of VOCs. This is due to the density of the contaminants being greater than water. The contaminants, therefore, reside low in the aquifer. A well pair located in the south-central portion of OU 2 typically exhibit VOC concentrations with dense contaminants. The deep-screened well, CDM-198-608, typically contains higher concentrations of VOCs than the shallow-screened well, CDM-198-606.

Wells located along the subsurface paleochannel that runs approximately south to north along Quebec Street, typically contain moderate concentrations of VOCs. PCE and TCE concentrations in wells CMW-05, CMW-09, CMW-10 and CMW-13 typically exceed or are close to the MCLs.

Concentrations of VOCs in samples are non-detectable or considerably below MCLs for wells along the northern and western boundaries of OU 2. During the last sampling event in May 2002, a few wells throughout OU 2 had unexpected increases in contaminant concentrations. The wells included CMW-06, CDM-198-605, FIT-IM-WP-01 and FIT-IM-WP-02. The unexpected results may be due to the depressed water table caused by the recent severe drought.

In summary, VOC concentrations (particularly PCE and TCE) have generally remained at consistent levels since 1995. The contamination of the groundwater, underlying OU 2, has remained within the predicted plume boundaries. As expected, the highest concentrations are found immediately downgradient of OU 1. In addition, impact from the OU 1 AS/SVE System has not yet been realized.

Data Review for Indoor Air Sampling

Because of the nature and extent of the VOC-contaminated groundwater and the lack of residential indoor air sampling data, CDPHE conducted an investigation of the indoor air pathway in the limited residential area of OU 1. The purpose of the investigation was to determine whether there is an unacceptable risk to human health from chemical vapors.

The Plume Area was chosen because the Source Area, the most contaminated area, does not have residential homes. In addition, the groundwater in the Plume Area is more contaminated than in OU 2. The contaminated groundwater moves in a northwardly direction from the Source Area to the Plume Area then to OU 2.

Three homes were sampled from May 24th through June 4, 2002. Samples were taken from basements and ambient air samples were taken just outside the homes. The sampling was conducted in accordance with the EPA-approved *Standard Operating Procedures for Air*

Sampling Collection (CDPHE, April 2002).

Results of the investigation are documented in the *CDPHE Indoor Air Assessment Report, Chemical Sales Superfund Site, Operable Unit 1* (CDPHE, August 2002). Figure 3 shows the locations of the homes and Table 2 shows the sampling results and target concentrations representing 10^{-6} (1 in 1,000,000) carcinogenic risk.

Sampling results for all COCs were at or below target concentrations, except for PCE in one home (5801R52). The PCE concentration of 8.1 ug/m^3 falls well within EPA's acceptable risk range of 10^{-4} (represented by a PCE concentration of 430 ug/m^3) to 10^{-6} (represented by a PCE concentration of 4.3 ug/m^3). Therefore, the indoor air pathways at the three homes currently pose no unacceptable exposure.

Although the PCE concentration may be the result of ambient conditions, the home (5801R52) will be sampled again within a year as a precautionary measure. The foundation and basement will be checked for cracks. Other sources of VOCs in and around the home will also be checked. As can be seen in Table 2, the ambient air sample for 5801R52 indicated a PCE concentration of 45 ug/m^3 which is higher than the PCE concentration of 8.1 ug/m^3 in the basement sample for 5801R52.

It should also be noted that EPA has reevaluated the human health impacts of the chemical 1,1 DCE. It reviewed all new information on this chemical since it was last evaluated in 1987. New data suggest that cancer response is not likely to occur in people. Therefore, EPA revised its allowable level for 1,1 DCE in residential indoor air. The net effect changes the action level from $.49 \text{ ug/m}^3$ to 210 ug/m^3 . The highest concentration of DCE found in CDPHE's investigation of the indoor air pathway was $.34 \text{ ug/m}^3$ (in 5801R52) which is below the old and new action levels.

ASSESSMENT

The following conclusions support the determination that the remedy at the Site is expected to be protective of human health and the environment upon completion.

Question A: Is the remedy functioning as intended by the decision documents?

- ***HASP/Contingency Plan:*** Both the Health & Safety Plan and the Contingency Plan are in place, sufficient to control risks, and properly implemented.
- ***Implementation of Institutional Controls and Other Measures:*** Access controls are in place at the Site including a fence and a warning sign. The Site fence is in good condition. The State Engineer's Office notifies residents in the area of potential contamination in groundwater, when

drilling domestic wells. There is no current or planned changes in land use at the Site.

- **Remedial Action Performance:** The system has been operating continuously since March 2000. As of July 2002, the total estimated amount of VOC mass recovered is 11,871.5 pounds. Present contaminant levels in groundwater are consistent with expectations at the time of the Site's decision documents.
- **System Operations/O&M:** O&M activities are being conducted in accordance with all appropriate plans and manuals. System operational procedures are consistent with requirements. Maintenance issues that have occurred with the AS/SVE System have been handled properly to date.
- **Opportunities for Optimization:** Injection of agents into the subsurface to facilitate biodegradation of VOCs by anaerobic dechlorination of VOCs to non-toxic forms will be explored. The area of interest centers on the Trammel Crow Building just west of the CSC property.
- **Early Indicators of Potential Remedy Failure:** No early indicators of potential remedy failure were noted during the review.

Question B: Are the assumptions made at the time of the remedy selection still valid?

- **Changes in Standards:** No newly promulgated or modified ARARs that would change the protectiveness of the remedies implemented at the Site were found.
- **Changes in Exposure Pathways:** No changes in site conditions that affect exposure pathways were identified as part of the five-year review. First, there are no current or planned changes in land use. Second, no new contaminants, sources, or routes of exposure were identified as part of this five-year review. Finally, there is no indication that hydrologic/hydrogeologic conditions are not adequately characterized. Present contaminant levels in groundwater are consistent with expectations at the time of the Site's decision documents.
- **Changes in Toxicity and Other Contaminant Characteristics:** Changes in toxicity and other factors for contaminants of concern, since the time of the Site's decision documents, do not call into question the protectiveness of the remedy.

EPA has reevaluated the human health impacts of the chemical 1,1 DCE. It reviewed all new information on this chemical since it was last evaluated in 1987. New data suggest that cancer response is not likely to occur in people. Therefore, EPA revised its allowable level for 1,1 DCE in residential indoor air. The net effect changes the action level from .49 ug/m³ to 210 ug/m³.

The highest concentration of 1,1 DCE found in CDPHE's investigation of the indoor air

pathway was .34 ug/m³ which is below the old and new action levels.

- ***Changes in Risk Assessment Methodologies:*** Changes in risk assessment methodologies, since the time of the Site's decision documents, do not call into question the protectiveness of the remedy.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No additional information has been identified that would call into question the protectiveness of the remedy.

DEFICIENCIES

Deficiencies were discovered during the five-year review. None of these are sufficient to warrant a finding of not protective as long as corrective actions are taken. The following are the discovered deficiencies:

1. **Degradation Enhancement.** Contamination under and around the Trammel Crow Building (just west of the CSC property) is not decreasing as quickly as the other areas of contamination. VOC concentrations in monitoring wells around the building are relatively very high.
2. **Continued Indoor Air Monitoring.** Although the indoor air pathways at the three homes sampled were found to pose no unacceptable exposure, the home (5801R52) with the highest PCE concentration needs further review as a precautionary measure. The ambient air sample for 5801R52 indicated a PCE concentration of 45 ug/m³ which is higher than the PCE concentration of 8.1 ug/m³ from the indoor air sample.

RECOMMENDATIONS AND FOLLOW-UP ACTIONS

With EPA oversight, the corresponding recommendations/follow-up actions are as follows:

1. **Degradation Enhancement.** Injection of agents into the subsurface to facilitate biodegradation of VOCs by anaerobic dechlorination of VOCs should be explored within a year of this report. The area of interest should center on the Trammel Crow Building just west of the CSC property.
2. **Continued Indoor Air Monitoring.** The home (5801R52) should be sampled again within a year of this report. The foundation and basement should be checked for cracks. Other sources of VOCs in and around the home should also be checked.

PROTECTIVENESS STATEMENT

The remedy at the Chemical Sales Company Superfund Site is expected to be protective of human health and the environment. The AS/SVE System is operating as designed. Contaminant levels in OU 1 monitoring wells are generally decreasing due to the system and natural degradation. The contamination of the groundwater, underlying OU 2, has remained within predicted plume boundaries. OU 2 (just north of OU 1) has not been impacted yet by the operation of the system. Present contaminant levels in groundwater are consistent with expectations at the time of the Site's decision documents.

NEXT REVIEW

The Chemical Sales Company Superfund Site is a statutory site that requires ongoing five-year reviews. The next review will be conducted within five years of the completion of this five-year review report. The completion date is the date of the signature shown on the signature cover attached to the front of the report.

APPENDIX A

Trend Analysis Figures For Source Area Wells

This section is not available online. Contact:

EPA Superfund Records Center
999 18th Street, Suite 500
Denver, CO 80202-2466
(303) 312-6473
or 1-800-227-8917 ext. 6473 (in Reg. 8 only)

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APPENDIX B

Trend Analysis Figures For Plume Area Wells

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APPENDIX C

Data Summary Tables for OU 2 Wells

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